Following, please find a MARKED UP VERSION OF CLAIMS 2-13 and 15-18 showing all changes made relative to the previous versions of those claims –

2. (Amended) The [composition] degraded, inhibited, cationic starch of claim [1,] 19 wherein the final peak viscosity of said starch is [130 to 800] about 110 to about 1000 percent of [the] a non-inhibited degraded cationized starch viscosity.

3. (Amended) The [composition] degraded, inhibited, cationic starch of claim [1] 19 wherein the starch is chosen from the group consisting of corn, tapioca, potato and sago and their waxy and high amylose versions thereof.

4. (Amended) The [composition] degraded, inhibited, cationic starch of claim [1] 19 wherein the starch is inhibited chemically.

5. (Amended) The [composition] degraded, inhibited, cationic starch of claim 4 wherein the starch is inhibited with epichlorohydrin.

6. (Amended) The [composition] degraded, inhibited, cationic starch of claim [1] 19 wherein the starch is inhibited thermally.

7. (Amended) The [composition] degraded, inhibited, cationic starch of claim [1] 19 wherein the degraded starch has a WF of about 15 to 85.

8. (Amended) The [composition] degraded, inhibited, cationic starch of claim 7 wherein the degraded starch has a WF of about 20 to 70.

9. (Amended) The [composition] degraded, inhibited, cationic starch of claim 8 wherein the degraded starch has a WF of about 35 to 65.

10. (Amended) The [composition] degraded, inhibited, cationic starch of claim [1] 19 wherein the cationic group is a quaternary ammonium derivative.

11. (Amended) The [composition] degraded, inhibited, cationic starch of claim [1] 20 wherein the degraded, cationic, inhibited starch has a peak viscosity of less than 250 centipoise.

12. (Amended) The [composition] degraded, inhibited, cationic starch of claim [11,] 19 wherein the starch is [chosen from the group consisting of corn, waxy corn, tapioca and potato and is] modified to contain a quaternary amine group [and inhibited with epichlorohydrin, wherein the final peak viscosity of said starch is 130 to 800 percent of the non-inhibited degraded cationized starch viscosity].

13. (Amended) A process for preparing [the starch composition of claim 1,] a degraded, inhibited, cationic starch comprising the steps of[;]:

degrading the molecular weight of a native starch,

inhibiting the degraded starch with an inhibition agent in an amount of about 0.001% to about 0.05% by weight of dry starch, and

chemically modifying the degraded starch with a cationic reagent,

wherein the steps of inhibiting and chemically modifying the degraded starch with a cationic reagent occur concurrently with or subsequently to one another.

15. (Amended) A process for making paper comprising the steps of[;] adding the starch of claim [1] 19 to a papermaking system.

16. (Amended) The process of claim 15 wherein the starch is added in [the] granular form.

17. (Amended) A paper article comprising the starch of claim [1] 19.

18. (Amended) A paper article comprising the starch produced by the process of claim [12] 13.

REMARKS

Claims 1-18 are pending in the application. Claims 1-18 are rejected. Claim 1 is canceled. Claims 2-13 and 15-18 are amended. New claims 19-29 are added. No new matter is submitted with these Amendments.

Reply to the Rejection of Claims 1-18 under 35 U.S.C. § 103(a)

The Examiner has rejected Claims 1-18 as being unpatentable over International Application No. WO 97/46591 to Neale *et al.* ("Neale") in view of U.S. Patent No. 3,884,909 to Kightlinger *et al.* ("Kightlinger"). Specifically, the Examiner states –

> Neale et al relates to a granular crosslinked cationic starch added as swollen granules at the wet end of papermaking, i.e., furnish to improve strength of the paper. The swollen crosslinked cationic starch has a viscosity of less than 400 and preferably less than 50 cps, page 2. The crosslinking agent in Neale et al (page 3) is the same as the inhibiting agent of the present invention. The cross linking agent is used in an amount of at least 0.05% by weight of the starch. Degraded starch can be used, page 4 where, acid, alkali or enzyme treated starch are disclosed as suitable base starch for modification.
>
> Kightlinger et al discloses a depolymerized or degraded crosslinked cationic starch in granular form. The modified starch is added in the wet end of paper making, i.e., internal addition. The modified starch has superior retention, in addition to other properties of cationic starch such as strength. Thus, it would have been obvious to optimize the degree of degradation of the starch would achieve the optimum retention and strength. Inherently, the claimed viscosity would be inherently be present.

For the following reasons, Applicants respectfully traverse the Examiner's rejection of claims 1-18 as being unpatentable over Neale in view of Kightlinger.

Referring to Neale, therein is disclosed cross-linked cationic starches that is useful in papermaking. (Neale was cited in the present application as disclosing a highly inhibited cationized starch that can be swollen but not dispersed in an aqueous papermaking system (paragraph 0008 of U.S. Pub. No. 2002/0170693).) The modified starch is prepared by swelling a cationized cross-linked starch under conditions selected so that the viscosity of the swollen product is less than 400 cps (Abstract). Neale states that the starches that can be cross-linked include "all types of native starches, premodified starches or hybrids thereof." These include potato, maize, tapioca, wheat, rice, waxy maize and high amylose maize (p. 4, lines 2-7).

The starch is modified by crosslinking the starch with an agent such as sodium trimetaphosphate ("STMP"), phosphorus oxychloride and epichlorohydrin, with STMP being preferred (p. 3, lines 25-30; *see also*, p. 5, 'Best Mode of Carrying Out the Invention', and Examples A-C). The amount of cross-linking agent used is 0.05% or more by weight of starch, with 0.05% to 1.0% being most preferred (p. 3, line 31 – p. 4, line1). This high level of cross-linking agent is required in the invention according to Neale in order to prevent over-swelling or rupturing, thereby obtaining modified starches with gel point ranges that are higher than the unmodified starch (p. 3, lines 21-23; Table 6). As such, Neale teaches that high or strong cross-linking is critical in keeping the granules intact.

The starch is cationized either subsequent to the cross-linking step or concurrent with the crosslinking step, with subsequent cationization being preferred (p. 4, lines 10-12; p. 3, lines 3-5). The cationization reagents include quaternary amine derivatives (p. 4, lines 13-16).

Although Neale includes potato as one of the starches useful for his invention, he notes that the average particle size of potato starch modified according to his invention is 99.8 μ (*see*, p. 7, Table 2 of Neale). Neale then states that 75% of the swollen starch should be within a particle size range of 15 to 90 microns, and that granules greater than 90 microns "tend to be too sparsely spread throughout the paper sheet to provide a uniform strength" (p. 9, lines 8-13; see also, p. 10, Table 4 and lines 3-9).

Neale teaches a gel point range of the modified starch that is higher than that of the unmodified starch (*see*, p. 6, Table 1). According to Neale, this is preferred because it prevents the starch granules from rupturing, bursting or cooking out in the wet end application (p. 6, lines 29-33). Neale further teaches swelling the modified granules by heating them, *e.g.*, in a jet cooker at 70°C (*see*, p. 5, 'Best Mode of Carrying Out Invention', lines 19-20), and then adding these swollen granules to the paper pulp at the wet end stage (p. 5, lines 20-25). According to Neale, an effective amount of modified starch to add to the pulp should be between 1.0% and 10.0% based on the weight of dry fiber (p. 5, lines 20-22). As exemplified, Neale discloses amounts of 3.7% (Example A), 3.8% (Example B), 3.5% (Experimental Trial A) and 3.01% (Experimental Trial B).

Referring to Kightlinger therein is disclosed a gelatinizable cross-linked cationic starch and a method for its manufacture. This modified starch is produced by (step 1) reacting a starch

with an alkali-catalyzable crosslinking agent and the reaction product of the crosslinking agent with ammonia or with an amine, and then (step 2) depolymerizing the resulting cationic crosslinked product (Abstract; col. 2, lines 5-9). Without the subsequent depolymerization step, the residual crosslinker in the first step will cause normally unwanted high crosslinking to occur. The depolymerization step avoids additional processing costs associated with removing the excess crosslinker, bringing the modified cationic starch back to a viscosity normally seen with other starches (*see*, col. 1, line 54 – col. 2, line 4). The amount of depolymerization is directly related to the extent of crosslinking undergone by the starch in the first step of the process (col. 6, lines 51-57). Accordingly, Kightlinger provides no unique viscosity range for superior performance.

Kightlinger claims a wide variety of starches for use in the process of the invention, including corn, potato, tapioca, wheat, waxy sorghum, waxy maize, grain sorghum, and rice, all of which can be modified or unmodified (col. 2, lines 60-68). Preferred crosslinkers for use in the Neale invention include 1,3-dichloro-2-propanol, 1,4-dichlorobutene-2 and epichlorohydrin (col. 4, lines 2-4). The amount of crosslinking agent used should be enough to produce a cationic intermediate starch product that, prior to depolymerization, has a Sedimentation Value ('SV') of from about 81 to about 98 (col. 4, lines 5-24). Suitable cationic reagents include alkali metal hydroxides and quaternary ammonium bases, of which sodium hydroxide is preferred (col. 5, lines 40-48).

"In determining the propriety of the Patent Office case for obviousness in the first instance, it is necessary to ascertain whether or not the reference teachings would appear to be sufficient for one of ordinary skill in the relevant art having the reference before him to make the proposed substitution, combination, or other modification." *In re Linter*, 458 F.2d 1013, 1016, 173 USPQ 560, 562 (CCPA 1972).

Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either explicitly or implicitly in the references themselves or in the knowledge generally available to one of ordinary skill in the art. "The test for an implicit showing is what the combined teachings, knowledge of one of ordinary skill in the art, and the nature of the problem to be solved as a whole would have suggested to those of ordinary skill in

the art." *In re Kotzab,* 217 F.3d 1365, 1370, 55 USPQ2d 1313, 1317 (Fed. Cir. 2000). See also *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992).

As shown above, Neale is directed towards modified cationic starches that are strongly crosslinked in order to keep the granules intact, and thereby enhance their performance. As such, one skilled in the art would not be lead to believe that a starch that has been highly degraded and inhibited within a limit much lower than that taught by Neale (for the present invention, about 0.001% to about 0.05% by weight of dry starch), thereby producing granules that can rupture and gel at a temperature lower than the temperature of the base starch, would result in a product with improved paper strength.

Kightlinger discloses products produced by a process of first crosslinking and/or cationizing a starch, and then depolymerizing the starch. Kightlinger does not teach or suggest a particular viscosity range for enhanced performance. Further, Kightlinger does not teach or suggest a range of inhibition. Accordingly, even if one skilled in the art were motivated to combine Neale with Kightlinger, one still would not have the degrade, inhibited, cationic starches of the presently claimed invention. Accordingly, neither Neale nor Kightlinger, alone or in combination, teach or suggest the presently claimed invention.

It is believed that these remarks overcome the Examiner's rejection of claims 1-18 as amended as being unpatentable over Neale in view of Kightlinger under 35 U.S.C. § 103(a). Withdrawal of the rejection is respectfully requested.

It is believed that the above amendments and remarks overcome the Examiner's rejection of the claims under 35 U.S.C. § 103(a) as indicated herein above. Withdrawal of the rejection is therefore respectfully requested. Allowance of the claims is believed to be in order, and such allowance is respectfully requested.

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